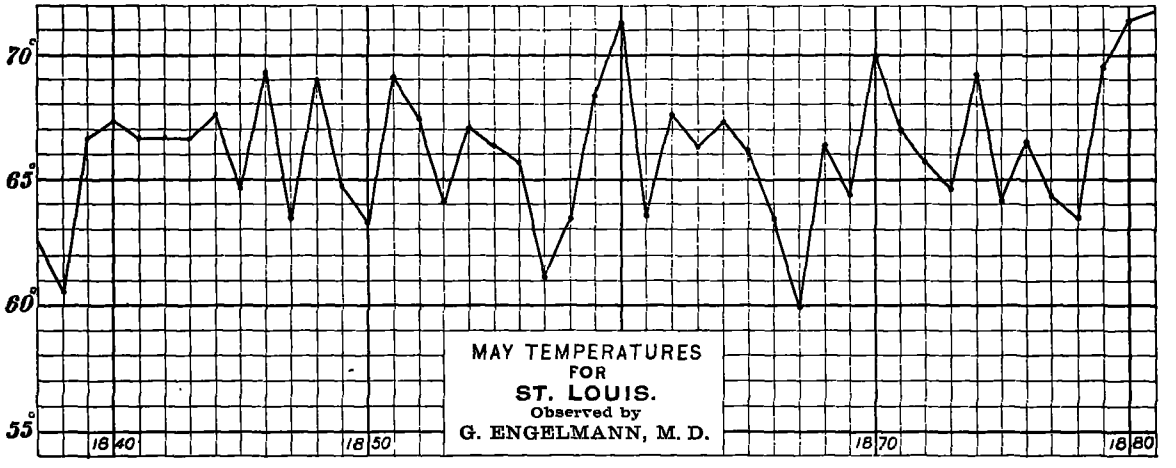
weather still prevailed. 10th, disappeared to the northwest in an area of high pressure then prevailing over Iceland and to the southward. The following descriptions relate to the storms of Eastern Asia and the Pacific Ocean: No. VI.—On the 3d and 4th the barometer fell to the southwest of the Japan Isles, forming a slight depression which, on the 5th, passed over them to the northeast, with winds changing from northeast to southeast and southwest. Occasional light rains accompanied the depression on the first two days. On the 6th the centre passed eastward over the ocean. No. XI.—For some three days previous to the formation of a well defined area of depression the pressure over northern China had shown considerable variability. On the 11th, centre of depression lay to the northwest of Pekin, barometer at that station 29.39, SW., fair; the pressure to the southeast, at Shanghai and at other stations along the coasts of the Yellow and Japan seas, was below 29.60, with occasional rains. 12th, central over the Japan Sea; winds over the Japan Isles from southeast to southwest and to the northward, along the coast of Corea, from northeast to northwest; in 38° N. 150° E., barometer, 29.45, E., strong gale, heavy rain. 13th, passed eastward to about longitude 150° E. and thence northeastward over the North Pacific Ocean to the Aleutian Islands, whence the course again changed to east. On the 16th, reached the Alaska Peninsula, disappearing thereafter in an area of high pressure prevailing along the Pacific coast of North America. No. XIV.—On the 16th and 17th the pressure fell over southern China and particularly along the coast, where southeast to southwest winds and light rains prevailed. 18th, lowest pressure passed northeastward to the Yellow Sea; in 37° 30′ N. 122° 12′ E., barometer, 29.47, NNW., strong gale, light rain; Shanghai, 29.72, SW., fresh, cloudy; Nagasaki, 29.82, SW., brisk, cloudy; Pekin, 29.71, NW., fresh, light rain. 19th, depression passed east northeast over the northern portion of the Japan Islands, followed by rapidly rising pressure and winds shifting to west and southwest; rain still continued at Japanese stations and commenced along the northern coast of the Japan Sea. 20th, depression disappeared over the ocean. No. XX.—This area was probably a continuation of low area No. X from the European coast, but because of the entire absence of data over eastern Siberia it was not thought advisable to unite the two. On the 25th and 26th depression passed eastward to the south of the Kamtchatka Peninsula and thence northeastward over Kamtchatka Sea, reaching Alaska by the 28th. The barometer at Ft. St. Michaels fell steadily from the 26th, reaching its minimum on the 28th, 29.48, S, light rain. The winds at Unalaska shifted from northwest to southeast and southwest, accompanied on the 28th and 29th by light rains and rising temperature. 29th and 30th, depression disappeared to the eastward over British America, probably uniting with low area No. XXV, then central over the Saskatchewan Valley; a further description of this storm will probably appear in the JUNE REVIEW. Compared with June, 1878, Chart No. VI presents several points of resemblance as well as of contrast. Within the United States the storm tracks are confined to higher latitudes, none reaching to any extent south of parallel 40°. Over the Atlantic Ocean the same peculiarity is observed, added to which is the fact that the storm paths to the east of Greenland have pursued very much the same course, passing north northeastward between that country and Iceland, or skirting the eastern border of the latter. No storm, so far as our data can be depended upon, actually reached the mainland of Europe from America, while in June, 1878, two passed over the ocean in a distinct manner, and to a considerable distance inland. In western British America there is presented a striking similarity in the movement of a single area for each month, coming, as it did in each instance, from the neighborhood of Alaska and passing thence southeastward into the United States, the paths of each being almost identical. The peculiarity of the disappearance of storm areas over, or in the vicinity of Hudson's Bay, presents a noticeable resemblance for the two years. Three disappeared in June, 1878, and four in June, 1879. Over northwestern Siberia and in northern Russia the presence of storm areas was a marked feature of the month in June, 1879, while hardly one appeared over this territory in June, 1878. This contrast may appear more intelligible when we recall under the description of Chart No. V (this REVIEW) the comparatively higher pressures over this region in the latter year.

TEMPERATURE OF THE AIR.

The mean temperature of the air for May, 1881, is shown by the isothermal lines (in red) on Chart No. II. The table of mean and comparative temperatures in the right-hand corner of the chart shows, in the first column, the average for the month throughout the various districts, as deduced principally from observations taken at Signal Service stations. In the two remaining columns are shown the means for the present month, and the departures of such means from the average for many years. With the exception of the Rio Grande valley, the Southeast Rocky Mountain Slope and the Florida Peninsula, the temperature is everywhere above the normal, ranging from +0°.6 in New England to +6°.2 in the Upper Mississippi valley. The greatest departures are confined to the northern portions of the country east of the 100th meridian. A normal condition is reported from the Florida Peninsula, and only a change of —0°.5 from the Southeast Rocky Mountain Slope.

Deviations from Mean Temperatures.—Under this heading departures exhibited by the reports from the regular Signal Service stations are shown in the table of comparative temperatures on

the right hand side of chart No. II. The following items of importance in connection with this subject are reported by voluntary observers: *Illinois*: Riley, mean temperature 0°.3 below that of past 20 years. *Iowa*: Clinton, month remarkable for high temperatures, the mean being above the average for several years. *Kansas*: Lawrence, mean temperature 3°.6 above that of past 13 years. Wellington, mean temperature 1°.9 above the normal; daily record of temperature remarkable for its uniformity, no extreme or sudden movements being observed; the minimum night temperature has averaged 15° higher than for the corresponding months of 1879 and 1880; the small range of temperature for the month (36°) taken in connection with sufficient moisture in the soil, the temperature being constantly at the germination point for vegetation, resulted in a vigorous growth of the same, which has greatly exceeded any previous record or the memory of the oldest inhabitants of this locality. *Maine:* Gardiner, mean temperature 0°.3 below that of past 45 years. *Maryland:* Fallston, mean temperature 2°.1 above that of past 10 years. *Missouri:* St. Louis, "Missouri Weather Service" reports mean temperature 5° above that of the past 45 years; during that period the highest means were reported as follows: 71°.3 in 1880 and 1860 and



70°.0 in 1870; the coldest May occurred in 1867, mean 60°.0. The above diagram shows the curve of mean temperatures for May, as furnished by Prof. T. E. Nipher, of the "Missouri Weather Service." *Nebraska:* Lincoln, "Nebraska Weather Service" reports mean temperature 2°.9 below the average; average of all noon observations 3° colder than May 1879 and 6° colder than in 1880. *New Hampshire:* Contoocookville, mean temperature 2° above that of past 10 years. *New Jersey:* Newark, mean temperature 2°.2 above that of past 35 years; highest maximum 96° occurred in 1880, lowest minimum 30° occurred in 1861; ground thermometers rose as follows: 18 inch from 50° to 62°, 36 inch from 48° to 56°; mean temperature of spring 47°.43 or 0°.81 below the average of past 35 years. *New York:* Waterburg, mean temperature 6°.1 above that of past 10 years. North Volney, mean temperature 4°.1 above that of past 13 years; highest mean during that period occurred in 1880, 62°.7, lowest in 1869, 52°.4. Palermo, mean temperature 4°.1 above that of past 28 years. *Ohio:* Cleveland, mean temperature 4°.7 above that of past 27 years; highest mean 65°.8 occurred in 1880, lowest 52°.4 occurred in 1867. *Pennsylvania:* Dyberry, mean temperature above the average for many years. *Virginia:* Wytheville, mean temperature 3° above that of past 17 years; maximum temperature for the month (90°) has been reached but 3 times in past 17 years. *West Virginia:* Flemington, month unusually warm.

Ranges of Temperature at Signal Service Stations.—Monthly ranges in general varied from 35° to 50° over the country east of the Rocky Mountains, and from 40° to 55° to the westward of that region. Ranges less than 45° occurred in the following districts: California, Southeast Rocky Mountain Slope, Rio Grande Valley, Gulf States, Tennessee, South Atlantic States, and at scattering stations in the Middle Atlantic States, New England, Upper Lake region, Missouri valley, and Northern Pacific Coast region. The *smallest ranges* were: Key West and San Diego, 22°; Port Eads and Punta Rassa, 24°; Cedar Keys and Galveston, 25°; San Francisco and Little Rock, 26°; Brownsville, Indianola and Pensacola, 29°; Shreveport, New Orleans, and Augusta, 30°. The *largest* were: Ft. Keogh, 64°; Fts. Shaw and Marquette, 63°; Ft. Buford, 62°; Ft. Lapwai, 61°; Ft. Assiniboine, 60°. The *daily ranges* varied in the different districts as follows: New England, from 21° on the summit of Mt. Washington and 22° at Wood's Holl to 35° at Portland, New London, and New Haven, and 43° at Boston; Middle Atlantic States, 18° at Cape May and 21° at Delaware Breakwater to 31° at Washington and Philadelphia and 33° at New York; South Atlantic States, 22° at Kittyhawk, Savannah, and Cedar Keys, and 27° at Smithville and Charlotte to 29° at Augusta; Eastern Gulf States, 15° at Key West and 20° at Punta Passa to 27° at Mobile

and 29° at Montgomery; Western Gulf States, 18° at Port Eads and 20° at Little Rock and Galveston to 28° at Corsicana, Fredericksburg and San Antonio and 30° at Mason; Rio Grande valley, 23° at Brownsville to 33° at Rio Grande and 36° at Eagle Pass; Ohio valley and Tennessee, 21° at Chattanooga and 24° at Cincinnati to 34° at Nashville, 36° at Morgantown and 41° at Pittsburg; Lower Lake region, 25° at Erie and 28° at Detroit to 33° at Cleveland, 34° at Oswego and 37° at Rochester; Upper Lake region, 27° at Grand Haven and 29° at Duluth to 34° at Alpena and 41° at Port Huron; Upper Mississippi valley, 19° at Cairo and 24° at Davenport and St. Louis to 30° at Springfield and 32° at Des Moines and St. Paul; Missouri valley, 27° at Omaha and 29° at Leavenworth to 31° at Yankton and 39° at Ft. Bennett; Extreme Northwest, 37° at Moorhead and 46° at St. Vincent to 53° at Ft. Stevenson and 56° at Ft. Buford; Northern Slope, 36° at Cheyenne and 38° at North Platte to 40° at Deadwood and 49° at Ft. Keogh; Middle Slope, 19° on summit of Pike's Peak and 29° at Dodge City to 32° at Fort Elliott and 36° at Denver; Southern Slope, 28° at Fts. Sill and Griffin and 34° at Concho to 42° at Stockton, 48° at El Passo and 50° at Davis; Northern Plateau, 38° at Lewiston and 39° at Boise City to 45° at Dayton, and 50° at Missoula; Middle Plateau, 33° at Pioche and Salt Lake City to 48° at Winnemucca; Southern Plateau, 25° at Shakespeare and 31° at Santa Fe to 48° at Florence and 49° at Camp Thomas and La Mesilla; North Pacific Coast, 33° at Portland to 38° at Olympia and 42° at Roseburg; Middle Pacific Coast, 23° at San Francisco to 32° at Sacramento and 35° at Red Bluff; South Pacific Coast, 19° at San Diego to 39° at Los Angeles and Yuma, 41° at Visalia and 59° at Campo.

Table of Maximum and Minimum Temperatures for May, 1881.

State or Territory.	Signal Service.			U. S. Army Post Surgeons or Voluntary Observers.		
	Station.	Max.	Min.	Station.	Max.	Min.
Alabama	Montgomery	96°	58°	Auburn and...		
Do				Green Springs		56°
Arizona	Tucson	106°		Texas Hill	108°	
Do	Yuma		31°			
Arkansas	Little Rock	87°	61°	Mt. Ida	88°	
Do				Fayetteville		48°
California	Visalia	95°		Turlock	109°	
Do	Campo		31°	Summit		30°
Colorado	Denver	84°		Hermosa	92°	
Do	Pike's Peak		5°			
Connecticut	New London	89°				
Do	New Haven		36°			
Dakota	Ft. Bennett	92°	28°	Ft. Buford		22°
Do	Bismarck		28°			
Delaware	Breakwater	82°	45°	Dover	90°	
Dist. Columbia	Washington	95°	44°			
Florida	Jacksonville	96°	63°	Ft. Barrancas,		
Do				St. Augustine		
Do				and Honston		60°
Georgia	Augusta	98°		Forsyth	99°	
Do	Atlanta		52°	M'Pherson Bks		50°
Iowa	Dubuque	90°		Clinton	95°	35°
Do	Davenport		38°			
Idaho	Ft. Lapwai	88°	27°			
Do	Lewiston and					
Do	Boise City	88°				
Illinois	Springfield	88°	37°	Peoria and		
Do	Chicago	88°		Elmira	93°	
Indiana	Indianapolis	89°	44°	Logansport	99°	
Do				Spiceland		41°
Indian Ty	Fort Gibson	92°				
Do	Fort Sill		56°			
Kansas	Leavenworth	90°	48°	Independence	93°	
Do				Clay Centre	93°	40°
Kentucky	Louisville	93°	51°			
Louisiana	Shreveport	92°		Pt. Pleasant	93°	
Do	New Orleans		60°			
Maine	Portland	86°		Gardiner		27°
Do	Eastport		32°			
Maryland	Baltimore	95°	46°	Woodstock		38°
Massachusetts	Boston	91°	36°	Williamstown		25°
Michigan	Marquette	88°	25°	Hudson and		
Do	Port Huron	88°		Litchfield	94°	
Do				Ft. Brady		24°
Minnesota	Moorhead	88°		New Ulm	89°	
Do	St. Vincent		28°			
Mississippi	Vicksburg	94°	62°			
Missouri	St. Louis	91°	43°			
Montana	Fort Keogh	98°				
Do	Ft. Assiniboine					
Do	& Rock Creek		20°			
Nebraska	North Platte	88°	37°	Ft. Niobrara	96°	
Nevada	Winnemucca	86°	28°	Carson City	94°	
Do				Palisade		25°
N. Hampshire	M. Washington	61°	8°	Contoocook'e	88°	
New Jersey	Sandy Hook	91°		South Amboy	97°	
Do	Barnegat		37°	Atco		32°
New Mexico	La Mesilla	101°		Ft. Union		28°
Do	Sante Fé		33°			
New York	New York City	93°		West Point	98°	
Do	Buffalo		32°	Madison B'ks		21°
North Carolina	Charlotte	94°		Weldon	96°	
Do	Fort Macon		50°	Murphy		43°
Ohio	Columbus	92°		Cincinnati		
Do	Cleveland		36°	Jacksonburg		
Do				and Ruggles	96°	
Oregon	Roseburg	85°	36°	Ft. Klamath		17°
Pennsylvania	Pittsburg	95°	38°	Milton	100°	
Do				Dyberry		21°
Rhode Island	Newport	85°	39°	Ft. Adams		35°
South Carolina	Charleston	91°	56°	Aiken	97°	53°
Tennessee	Knoxville	93°	49°			
Texas	Rio Grande	102°		Ft. Ringgold	106°	
Do	Fort Davis		41°	Ft. Brown		36°
Utah	Salt Lake City	86°	40°	Promontory	91°	
Do				Kelton		30°
Vermont	Burlington	85°	30°	Charlotte	90°	
Do				Woodstock		23°
Virginia	Lynchburg	96°		Accotink	97°	
Do	Fort Myer		43°	Ft Monroe		42°
Washington Ty	Almota	87°				
Do	Colfax		25°			
West Virginia	Morgantown	85°	39°	Flemington	90°	
Wisconsin	Madison	88°	35°	Beloit	91°	31°
Do	Milwaukee	88°				
Wyoming	Cheyenne	79°	32°	Ft. Fetterman	85°	
Do				Ft. Bridger		16°

Frosts were, with few exceptions, confined to that portion of the country north of parallel 40°. To the southward of that boundary they were reported as follows: Maryland, Fallston, 1st; Glyndon, 17th, 20th. Colorado, Pike's Peak, 13th, 21st, 22d, 25th. Nevada, Carson City, 7th, 17th, 18th, 19th, 23d, 24th, 25th. Arizona, Prescott, 11th. California, San Gorgonio, 1st, 2d, 11th, 24th to 26th; Campo, 26th, 29th, 30th. In the northern portion they were reported in the various districts as follows: New England, 1st, 3d to 5th, 14th; Middle States, 1st to 5th, 7th; Lower Lake region, 1st to 4th, 17th, 18th; Upper Lake region, 2d to 4th, 7th, 15th to 17th; Upper Mississippi valley, 2d, 4th, 15th; Missouri valley, 2d, 3d, 20th; Northern Rocky Mountain slope, 1st, 2d, 12th, 18th to 20th; Northern Plateau, 1st, 2d, 7th, 8th, 10th to 12th, 14th to 19th; North Pacific coast, 1st, 11th, 16th, 17th, 21st, 24th; Umatilla, 1st, injuring vegetation; Dayton, 22d, killing vegetables.

Ice formed during the month in few localities, and invariably in the region north of parallel 40°. Strafford, Vt., 1st, 3d, 4th, 5th; Mt. Washington, 14th; Fall River, Mass., 1st; Rowe, Mass., 3d, 4th, 5th; Friendship and Flushing, N. Y., 1st; Milton, Pa., 4th; Chicago, 4th; Eagle Rock, Idaho, 7th, 18th, 19th.

PRECIPITATION.

The general distribution of rainfall (including melted snow) for May, 1881, is shown on Chart No. III, from the reports of over 500 stations. From the table in the left hand corner of the chart is obtained a monthly average for each of the various districts, determined from the records (covering a period of many years) of Signal Service stations, and also a comparison of the present month with such averages. In general there is a marked deficiency for the month, which, however, is coupled with striking irregularities in the distribution, particularly in Texas and the Missouri valley, where in several localities the heaviest precipitation ever recorded has fallen. This unusual record of rain fall was probably due, in large measure to the peculiar direction and sluggish movement of low area No. V. The largest deficiencies occurred in the South Atlantic, Eastern Gulf States and in the North Pacific Coast region, where, particularly in the two former districts, large excesses are common to the month of May. The largest excess was reported from New England, where the deviation from the normal for the month has not been exceeded in any previous year since the establishment of Signal Service stations. The deficiency in the Upper Lake region, although small, is not unusual, while over the Lower Lakes the deficiency, though larger, is considerably below the average. The deficiency in the Upper Mississippi valley is very unusual and larger than ever before recorded. In the Southern Pacific coast region the condition is normal, being the only district reporting the same. Throughout the San Joaquin and Sacramento valleys the deficiency has been considerable, but few stations reporting any rainfall at all, the largest being 0.79 inches at Red Bluff. Over the Rocky Mountain and Plateau districts there appears to be an excess at many stations, although the usual irregularity of distribution is observable. Elsewhere the changes are unimportant.

In connection herewith the following notes from voluntary observers are of interest: *Alabama:* Auburn, month unusually dry. *Florida:* Houston, month very dry; no rain; garden truck drying up. *Georgia:* Forsyth, exceedingly dry; crops seriously injured. *Illinois:* Riley, monthly rain-fall 2.02 inches above mean for past 20 years, and only exceeded twice during that time, viz.: in 1861 and 1868. *Indiana:* Vevay, monthly rain-fall 3.24 below mean for several years; crops suffering severely. Wabash, rain-fall below the average; crops suffering. *Iowa:* Ft. Madison, month very dry; wells and streams drying up. Independence, month unusually dry; crops suffering; streams very low. *Kansas:* Lawrence, monthly rain-fall 0.64 below the average, but quite evenly distributed. Clay Center, month remarkable for frequent and heavy rains. Yates Center, month characterized by unusually heavy rains. Wellington, monthly rain-fall 6.84 above mean of past 2 years; month remarkable for an excessive and general distribution of rain-fall, and likewise for the absence of violent or heavy rains with stormy gales. *Maine:* Gardiner, month very wet; monthly rain-fall 2.02 above average for past 45 years. *Michigan:* Litchfield, month very dry; crops suffering and streams low. Thornville, month very dry; crops suffering. *Missouri:* St. Louis, "Missouri Weather Service" reports a deficiency of about 0.70; larger deficiencies were reported, as follows: 1.73 in 1860, 2.79 in 1870 and 1.51 in 1880; throughout the State the precipitation has been decidedly less than in 1878, more than in 1879 and about the same as in 1880. *Nebraska: Lincoln, "Nebraska Weather Service" reports average rain-fall for entire State at 6.65* inches, or 1.75 above the average for past 9 years, and double the rain-fall of 1880; in some parts of the State rain fell on 23 days. *New Hampshire:* Contoocookville, monthly rain-fall above the average of past 10 years. *New Jersey:* Newark, monthly rain-fall 1.25 below the mean of past 35 years; total rain-fall for spring 10.24, or 4.64 below the average for past 35 years. *New York:* Waterburg, monthly rain-fall 2.70 above average for past 9 years. North Volney, monthly rain-fall 0.22 above average for past 8 years; smallest rainfall for that period occurred in 1876; largest in 1878. Palermo, monthly rain-fall 1.10 below mean for past 22 years. *North Carolina:* Weldon, month very dry. *Ohio:* Cleveland, monthly rain-fall 2.34 below mean of past 27 years; largest precipitation during that period occurred in 1858, 7.74 inches; smallest in 1877, 0.75 inch. Ruggles, month very dry; crops suffering. *Tennessee:* Ashwood, month very wet; precipitation unusually heavy. *Texas:* Melissa, month remarkable for heavy rains; rain-fall for the month nearly the annual average; largest precipitation for the past 30 years. Clarksville, month remarkable for incessant rains. *Virginia:* Wytheville, monthly rainfall 0.93, or less than for any May in past 17 years except 1875, when it was 0.50; rain-fall for the month 2.67 below the average of the past 17 years; drought during the month very severe; crops suffering, and seed lying in the ground does not germinate. *West Virginia:* Flemington, month very dry; crops suffering, and wells and small streams drying up.

Special Heavy Rain-falls.—2d, Melissa, Tex., 3.00 inches. 3d, Mason, Tex., 2.19; Paducah, Ky., 2.19. 4th, Paducah, Ky., 2.25. 4th and 5th, Fort Davis, Tex., 2.85. 5th, Fayette, Miss, 2.00; Melissa, Tex., 4.00. 5th and 6th, Castroville, 2.22. 6th, Wellsboro' Pa., 2.10; San Antonio, 2.10; Browns-